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many changes which species have encountered through the course of ages, the peculiar adaptation to special temperatures has been among the least changeable of characters. Of course what are known as theories of evolution hardly find a parallel in the cases he had referred to. Evolution deals with the modification of organs. It is still the same organ though changed in form. The modified leaf is still a leaf, though it may be contended to be specifically distinct from its parent. In the cases he brought forward it was an absolute change of one organ to another organ. Yet he thought it was impossible to conceive of evolutionary movements wholly independent of morphological laws. However, he offered the facts for whatever they might be worth, and the suggestions on them only as leading to thought on the greater question.

On Green-Sand Vertebrata.—Prof. Cope made some observations on the vertebrates of the New Jersey cretaceous, and described the characteristics of several species of gavials. The genus *Hyposaurus* possesses a sagittal crest. The *H. fracterculus*, Cope, is the smallest of the species, and must be referred to the genus *Gavialis*. The chimæroid fishes are very abundant, about twenty species being included in a monograph of them now in course of publication. They belong to the genera *Leptomylus*, Cope, *Diphrissa*, Cope (type *Ischyodus solidulus*), *Ischyodus*, Egvt., and others. *Leptomylus forfex*, and numerous other species were described for the first time.

Effects of Cold on Iron.—Mr. Willard referred to two instances of the brittleness of iron under the prevailing low temperatures which he noticed yesterday. In breaking up an old locomotive, the cutting off of the rivet heads, which usually requires heavy sledging, was effected by a single blow, as if they were made of cast iron. In the forging of a long steamboat shaft of the best hammered iron which hung balanced in a crane, the hammering of the heated end caused vibration in the overhung end—harmless in ordinary temperatures, but at 10° F. sufficient to cause the beam to break sharp near the point of support. The published tests of iron and steel show no loss of tensile strength at low temperatures under a gradual stress, but all experience shows great loss of *body*, or ability to resist a blow.

February 16.

The President, Dr. Ruschenberger, in the chair.

Twenty-eight members present.

Mr. Henszey announced that Mr. Isaiah V. Williamson had given to the Academy ground-rents to the amount of $25,000, the interest of which is to be applied to the purchase of books for the library, and offered the following preamble and resolutions, which were unanimously adopted:—

WHEREAS, Our esteemed friend, Isaiah V. Williamson, having made a donation to the Academy of Natural Sciences of Philadelphia of the principal sum of Twenty-five Thousand and Eight Dollars $\frac{40}{100}$ (in ground-rent securities) as a permanent fund for the increase of the Library, it is proper that a suitable acknowledgment should be made; therefore,

Resolved, That the liberal donation made by Isaiah V. Williamson, Esq., of Twenty-five Thousand and Eight Dollars $\frac{40}{100}$, as a permanent fund for the use of the library, is of the greatest value in the promotion of science, thereby enabling students of the Academy to pursue their investigations with knowledge of all the information of the age, and that the Society therefore tender to him its most cordial thanks.

That this fund be named the I. V. Williamson Fund, and that the committee on the library be directed to prepare a suitable book-plate to include a record of the amount and date of acceptance of the gift, to mark every volume acquired through the I. V. Williamson Library Fund, so that students may know to whom they are indebted for such indispensable aid.

That the library committee be requested to obtain a portrait of Mr. I. V. Williamson and place it in the library among those of the distinguished philanthropists who have been benefactors of the Academy.

That a copy of the above preamble and resolutions, signed by the officers of the Society, be transmitted to Isaiah V. Williamson, Esq.

On motion of Prof. Frazer it was

Resolved, That a committee be appointed by the President which shall seek the co-operation of such scientific men throughout the country as it shall see proper to invite to join them in an effort to have a collection of ores, newer and rarer minerals, and other objects of natural history of the country at the coming Centennial exhibition.

On the Homologies of the Sectorial Tooth of Carnivora.—Prof. COPE made the following remarks on the probable origin of the sectorial tooth.

The series of dental types which precede the complex structures of teeth presented by the most specialized divisions of the hoofed mammalia, have been pointed out by the writer in an essay On the Origin and Homologies of the Types of Dentition of the Mammalia Educabilia.[1] From this discussion the analysis of the most specialized sectorial tooth of the carnivora, as seen in the Felidæ, was omitted. As light has been thrown on the subject by later researches, a note of the conclusions will be made here, chiefly with reference to the dentition of the lower jaw.

In the above essay I regarded the simple four-lobed or quadrituberculate molar of the hypothetical *Bunotherium* as the starting point of all more specialized forms of crested teeth. The second and third lower molars of the peccaries (*Dicotyles*) represent such a type. It was also pointed out that additional tubercles may be added to this, or to a still simpler form, by the development of basal cingula.

The genus *Hyopsodus* presents a modified form of quadrituberculate molar; in the genera *Pantolestes* and *Antiacodon* we observe that the tubercles are similar, excepting that the anterior inner is slightly bifid. In *Pelycodus* (whose systematic position is uncertain) the two apices of this tubercle are separated more widely from each other, so as to constitute two cusps. These are connected with the anterior outer cusp by acute ridges which thus form two sides of a triangular area; the anterior ridge is evidently a developed cingulum.

The tubercular molar of some *Viverridæ*, and among extinct forms especially of the *Didymictis protenus*, Cope, presents a similar structure to that just described. This furnishes a ready explanation of the tooth immediately in advance, which is the primitive form of sectorial tooth characteristic of that type of carnivora. The three anterior tubercles are largely developed, standing at opposite angles of a triangular space; the outer and anterior cusps are the most elevated, and the ridge which connects them is now a short cutting blade. The posterior portion of the tooth does not share in this elevation, and its two tubercles are in some genera replaced by an elevation of one margin which leans obliquely towards the middle of the crown. In *Mesonyx* this is represented by a median longitudinal crest. If the two tubercles of the posterior part of this tooth (which may be termed a *tubercular sectorial*) are elevated and acute, we have the molar of many recent and extinct *Insectivora;* if the same portion, now called a *heel*, is much reduced, we have the type of *Oxyæna* and *Stypolophus*. In the *Canidæ* the three anterior tubercles are much less elevated than in the genera above named; the external is much the larger, and the anterior removed further forwards so as to give the blade a greater antero-posterior extent. The heel is larger and without prominent tubercles. In the *Mustelidæ* the inner of the two median cusps is often reduced to a rudiment, or is entirely wanting, and the heel is large. The lower sectorial of the *Hyænidæ* has no inner tubercle, and the heel is much reduced. In some of the sabre-toothed tigers, the heel remains as a mere rudiment, while in the true cats it has entirely disappeared, and the carnassial tooth remains perfected by subtraction of parts as a blade connecting two subequal cusps. The *Hyænodontidæ*, as is known, possess three carnassial teeth without inner tubercles. The history of this form is as yet uncertain, as it was evidently not derived from contemporary forms of the Eocene with tubercular sectorials.

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[1] Journal of the Academy of Natural Sciences of Philadelphia, 1874.

The development of the carnassial dentition has thus been accomplished, first by an addition of anterior cusp, and subsequently by the subtraction of the inner and posterior cusps, so that of the original four of the quadrituberculate molar but a *single one*, *i. e.*, the anterior external, remains. The same process may be observed in the successional modifications of the entire dentition of the jaws. The Eocene forms of Carnivora frequently display more numerous sectorial teeth (such as they are) than any of the existing families. The important change which is clearly indicated is the progressive extinction of the genera with numerous sectorial teeth, accompanying the increasing specialization of the sectorial tooth in the genera which remain. In other words, the numerous types of digitigrade carnivora which have survived, are those developing but one sectorial tooth (whose earliest representative is Didymictis). The increased perfection of the sectorial has been associated with a reduction in the number of other molars, first posterior, then anterior to it. which reduction has been accompanied by an increased relative size of the sectorial. By this process concentration of the carnassial function has been gained, and increased robustness of the jaws, by progressive shortening. The slender form of the rami of the Eocene genera and *Hyænodon*, are much less efficient in functional use than the stout jaws of existing *Mustelidæ*, *Hyænidæ*, and *Felidæ*.

A second point in the history of the Eocene Carnivora remains to be considered. In all of the genera which I have had the opportunity of examining, excepting *Mesonyx*, namely, *Amblotonus*, *Oxyæna*, *Prototomus*, and *Didymictis*, the tibio-astragalar articulation is of a primitive character. The astragalus is flat, and the applied surfaces are nearly plane, and without the pulley-shaped character seen in existing Carnivora, as dogs, cats, and, in a less degree, in the bears, and in other Mammalia with specialized extremities, as *Perissodactyla*, *Artiodactyla*, etc. The simplicity of structure resembles, on the other hand, that found in the oppossum, and various *Insectivora*, *Rodentia*, and *Quadrumana*, and in the *Proboscidia*, most of which have the generalized type of feet. The structure indicates that the carnivorous genera named were plantigrade, a conclusion which is in conformity with the belief, already expressed, that the Mammalia of the Eocene exhibit much less marked ordinal distinction than do those of the Miocene and the recent periods. It is indeed questionable whether some of the genera here included in the *Carnivora* are not gigantic *Insectivora*, since the tibio-tarsal articulation in many, the separation of the scaphoid and lunar bones in *Synoplotherium*, the form of the molars, and the absence of incisor teeth in some, are all characteristic of the latter rather than the former order.

FEBRUARY 23.

The President, Dr. **RUSCHENBERGER**, in the chair.

Twenty-four members present.

Dr. Geo. H. Horn was elected a member of the Council, to fill the vacancy created by the resignation of Dr. LeConte.

J. Towers Pennypacker, Peter F. Rothermel, and Charles E. Hall were elected members.

The Committees to which they had been referred recommended the following papers to be published :—